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Biosurfactant As the Next Antimicrobial Agents in Pharmaceutical Applications

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Abstract

The number of patients with antimicrobial resistance is growing as a result of new emerging microbes or overuse of antibiotics. A new substitute to the existing antimicrobial agents is important in time to come to control the mortality rate in the global population. Natural substances, like biosurfactants or commonly known as microbial surfactants could be a potential antimicrobial agent to medical personnel's consideration as some biosurfactants exhibits antimicrobial activity. Hence, this paper will briefly highlight some of the findings from contemporary researchers who have tested different biosurfactants for potential antimicrobial activity.

Keywords: Antimicrobial; Resistance; Microbes; Mortality; Biosurfactant

Introduction

According to World Health Organization (WHO), 2014 [1] report antimicrobial resistance is one of the biggest health problems faced globally. Mortality rate due to antibiotic resistance has become unstoppable like the globalization force. As the world is growing with technology newer microbial species are emerging as a result of antigenic drift due to random mutation and leading to fatality. On another note unnecessary antibiotic prescription too has a huge contribution towards the microbial resistance as this causes the body to build up resistance to the prescribed drugs. Thus, antibiotics becomes ineffective. Pneumonia, tuberculosis, blood poisoning and foodborne diseases are some of the reported growing infectious diseases globally [1]. The mentioned disease requires a serious attention and need to be treated soon to prevent its impact on our life expectancy. Food safety factsheet by WHO reported that over 500 million people became sick and approximately 230 000 deaths were recorded from diarrheal diseases that resulted from food poisoning. In a common man's book food poisoning is a normal disease and can be treated with antibiotics. Unfortunately, they are unaware of the bitter truth that the common bacteria like Staphylococcus aureus, *Escherichia coli*, Salmonella, Campylobacter and Vibrio cholerae classified as foodborne bacteria are becoming resistant to the available antibiotics these days [2,3] Likewise, number of deaths for tuberculosis in the past 5 years is at its alarming rate where over 10 million deaths were recorded worldwide outnumbering HIV/AIDS deaths [4]. It seems like controlling the spread of this single infectious agent, *Mycobacterium tuberculosis* is a big challenge with the existing antibiotics [5]. Not to deny that all this scenario and case reports fears the medical officers on what is going to happen to the human population if the current antibiotics resistance continues to escalate and what other alternatives to control the microbial colonization and spreading in patients. This paper seeks to remedy this problem by analysing literatures on biosurfactant as an optional antimicrobial substitute to counter the current antimicrobial resistance.

Biosurfactant

Biosurfactant is a word derived from surfactant that is surface active agents. Surfactants are resourceful molecules that are synthesized chemically have emulsifying properties and reduce surface tension between surfaces [6]. On the other hand, biosurfactant is a biologically friendly extracellular molecules synthesized naturally mostly by living organisms on sustainable sources [7]. These molecules are also called as amphipathic molecules due to presence of hydrophilic and hydrophobic that helps form micelles to carry out its function [8,9]. Ample of literatures are available on biosurfactant describing their types and applications. In fact, there are many industries have started practicing them due to their low toxicity, environmentally friendly, bio-compatible and digestibility properties [10]. Biosurfactant, a natural surfactant secreted by microorganisms mostly by bacteria and fungi [11] should be considered and could be a great alternative as a natural antimicrobial agent. In addition, the growing awareness and understanding on the need to opt for natural products could be an advantageous factor to practice biosurfactant as antimicrobial agents in pharmaceutical applications. This justifies the reason and research interest of our scientific community towards biosurfactant in the recent years.

Antimicrobial Study

Much work on the potential of biosurfactant solely or in combination with other antibiotics as antimicrobial agent has been carried out in the last ten years is depicted with the number of literatures available in the scientific database. Several papers on antimicrobial potential of lipopeptides and glycolipids suggest that it is time to consider biosurfactant in medical practice. The findings of some of the paper will be highlighted in this paper to stress on the importance to adopt biosurfactants in pharmaceutical application in near future especially as an antimicrobial agent. To begin with, antimicrobial study using biosurfactant from two probiotics strains, Lactococcus lactis 53 and Streptococcus thermophilus A, inhibited the growth of some bacteria and yeast (*Staphylococcus epidermidis, Streptococcus salivarius,* Staphylococcus aureus*, Rothia dentocariosa,* Candida albicans and *Candida tropicalis*) that was isolated from a patient with explanted voice prostheses [Rodrigues et al.]. Remarkable inhibitory activity was noted in [12] findings where rhamnolipid surfactant, a glycolipid type from two Pseudomonas aeruginosa strains was used. The rhamnolipid at a concentration of 10 mg/ml inhibited the growth of *Bacillus cereus* with the largest zone of inhibition of 30 mm. Similar, zone of inhibition of 15 mm was reported for the remaining Gram-Positive clinical strains, Staphylococcus aureus and *Staphylococcus epidermidis.* According to the author, the biosurfactant basically interferes and destroys the cytoplasmic membranes of the test microorganisms due to its unique structural attributes (the presence of both hydrophobic and hydrophilic moieties in the biosurfactant). Another study by, [13] with the same bacteria using a different biosurfactant resulted in a clear zone of inhibition with a diameter of 12 mm for *E. coli* and 18 mm for *S. aureus*. Latest antimicrobial report by Garg and team [14] stated that biosurfactant extracted from *Candida parapsilosis* exhibited significant antibacterial activity against two tested bacteria, *Escherichia coli* and Staphylococcus aureus at the concentrations of 10 mg/ml and 5 mg/ml respectively. The author has also mentioned that the diameter zone of inhibition increased up to 28 mm and 26 mm for the above-mentioned bacteria when higher concentration of 15 mg/ml was used.

There is also literature on antimicrobial study as combinational therapy using biosurfactant and existing antibiotics to show the ability of natural surfactant functioning with chemically synthesized surfactants to control microbial growth. The study was carried out with Sophorolipid (SL) biosurfactant and tetracycline to completely inhibit the growth of Staphylococcus aureus. Initial study with just tetracycline application failed to completely inhibit S. aureus in more than 6 h. However, when the same bacteria were tested with SL and tetracycline, the bacteria were eliminated in 4 h suggest the strong interaction between the biosurfactant and antibiotics [15,16].

Conclusion

The evidence from previous findings suggest that biosurfactants are potential alternative antimicrobial agents and is a green solution towards the current antimicrobial resistance faced as a global health risk.

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